

REMARKS

Claim 1 has been amended to incorporate therein the recitation of claim 9. Claim 9 has been canceled.

Review and reconsideration on the merits are requested.

Claims 1, 3 and 4 were provisionally rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-3 of copending Application No. 10/591,584.

In response, claim 1 has been amended to incorporate therein the recitation of claim 9, to thereby obviate the foregoing obviousness-type double patenting rejection. Withdrawal is respectfully requested.

Claims 1, 2 and 4-9 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,297,442 to Yagi et al.

Yagi et al was cited as disclosing a semiconductor device meeting each of the terms of the rejected claims, comprising a p-type GaN compound semiconductor layer 21, including a top portion (21-a) and an inner portion (21-b), where the inner portion (21-a) contains a p-type impurity element and, in combination therewith, hydrogen (citing col. 6, lines 60-62, col. 14, lines 6-8 and Fig. 5).

Applicants traverse, and respectfully request the Examiner to reconsider in view of the amendment to the claims and the following remarks.

The p-type layer of amended claim 1 is characterized as containing a p-type impurity and exhibiting p-type conduction. The p-type layer comprises a top portion and an inner portion located under the top portion, wherein the inner portion contains the p-type impurity element

and, in combination therewith, hydrogen. Furthermore, the top portion has a hydrogen content that is less than the amount of hydrogen contained in the inner portion.

As described in the Background Art portion of the present specification, in a conventional process, a gallium nitride-based semiconductor layer is formed by addition of a Group II impurity to the layer, followed by heating in order to remove hydrogen contained in the layer. However, even when an LED is fabricated using a low resistance p-type layer obtained in this manner, a problem arises in that the desired electrostatic blocking voltage characteristics cannot be obtained.

The present invention has been made to solve the above-noted problems of the prior art.

More particularly, the present invention provides a device, and specifically an LED, having excellent electrostatic blocking voltage characteristics, and which can be obtained by fabricating the high resistance inner portion so as to contain hydrogen. Further, an LED having a lower forward voltage can be obtained by fabricating the lower resistance top portion to have a hydrogen content that is less than the amount of hydrogen contained in the inner portion (i.e., the recitation of claim 9 as incorporated into claim 1).

Fig. 5 of Yagi et al cited by the Examiner discloses a solar cell having a transparent conductive substrate 20, a metallic oxide compound semiconductor 21-b, and a Group III-V compound semiconductor 21-a.

The passage of Yagi et al at col. 14, lines 16-8 discloses that the p-type GaN layer contains hydrogen and Mg.

In contrast, Yagi et al at col. 5, lines 44-46 discloses that preferred examples of the metallic oxide compound semiconductor 21-b include titanium oxide and zinc oxide. Col. 5, lines 54-58 of Yagi et al discloses that titanium oxide and zinc oxide are n-type semiconductors

owing to an oxygen bond defect formed by deviation of the oxygen concentration from stoichiometric proportions.

In short, the laminated structure shown in Fig. 5 of Yagi et al comprises an n-type semiconductor layer 21-b and a p-type semiconductor layer 21-a. Yagi et al does not disclose a p-type semiconductor layer comprising two layers, namely, a top portion and an inner portion having the characteristics as recited in present claim 1.

As a concrete example, Example 3 of Yagi et al bridging cols. 13-14 discloses a laminated structure comprising an n-type layer, an i (insulated)-type layer and a p-type layer, and does not disclose a p-type layer comprising each of two layers having the specific characteristics as recited in amended claim 1.

The passage of Yagi et al at col. 4, lines 20-22 simply discloses that the photoconductor preferably contains hydrogen, and that the concentration of hydrogen is preferably 50% by atom or less. This passage of Yagi et al does not disclose the characteristic feature of the present invention wherein the top portion of the p-type layer has a hydrogen content that is less than the amount of hydrogen contained in the inner portion. Furthermore, none of the embodiments and Examples in Yagi et al describes, suggests or otherwise discloses the above-noted characteristic features of the present invention.

As discussed above, Yagi et al neither discloses nor suggests the characteristic feature of amended claim 1 which calls for a p-type layer comprising a top portion and an inner portion, wherein the hydrogen content of the top portion is less than that of the inner portion.

For the above reasons, it is respectfully submitted that the present claims define novel subject matter, and withdrawal of the foregoing rejection under 35 U.S.C. § 102(b) is respectfully requested.

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Yagi et al.

Applicants rely on the response above with respect to the rejection of claims 1, 2 and 4-9 over Yagi et al.

Withdrawal of the foregoing rejection is respectfully requested.

Withdrawal of all rejections and allowance of claims 1-9 is earnestly solicited.

In the event that the Examiner believes that it may be helpful to advance the prosecution of this application, the Examiner is invited to contact the undersigned at the local Washington, D.C. telephone number indicated below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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